

Late Cretaceous ophiuroids in the Binkhorst Collection at the Museum für Naturkunde, Berlin, reassessed

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A small lot of latest Cretaceous brittlestars from the Maastrichtian type area, contained in the Binkhorst [van den Binkhorst] Collection at the Museum für Naturkunde in Berlin, is restudied and, in part, illustrated for the first time. Presumably, these thirteen specimens represent only a portion of the ophiuroid material referred to in two papers by Binkhorst van den Binkhorst, both published in 1859, because all are assignable to two species which are common only in the Nekum and Meerssen members of the type Maastrichtian, namely *Felderophiura vanderhami* Jagt, 1991, and *Ophiomusium lux* Jagt & Kutscher in Jagt, 2000. Brittlestar material from lower levels within the Maastricht Formation (i.e., Valkenburg, Gronsvelt, Schiepersberg and Emael members) referred to by Binkhorst has not been traced. Alternatively, Binkhorst's original records could have been based on specimens contained in collections of his contemporaries, such as Joseph de Bosquet and Casimir Ubaghs. In most, if not all, of such cases, representatives of *Ophiomusium* gr. *granulosum* (Roemer, 1841) [sensu Jagt, 2000] are involved. Based on our own observations in the Maastricht area, Binkhorst's specimens of *F. vanderhami* and *O. lux* must have originated from the upper Meerssen Member where these two species are locally common. In fact, mostly isolated discs are preserved in the present lot, with only some retaining proximal arm portions, which suggests these were picked from sieving residues after bulk sample processing. More or less complete specimens of both species have also been collected recently, but these are confined to bedding planes. Although preservation is mediocre, diagnostic features of both *F. vanderhami* and *O. lux* are readily apparent.

Contents

Introduction	151
Material and methods	152
Reassessment of material	153
Discussion	155
Acknowledgements	155
References	155

Introduction

Late Cretaceous (Campanian-Maastrichtian) and Early Paleocene (early-middle Danian) ophiuroid faunas from the type area of the Maastrichtian Stage (southern Limburg, the Netherlands; Belgian provinces of Limburg and Liège; Aachen area in Germany) have recently been revised by Jagt (2000). Jagt (2000, pp. 3-6) discussed earlier records of brittlestars, most of which were merely listed or cursorily mentioned, but rarely commented upon in detail, let alone illustrated.

Binkhorst van den Binkhorst (1859a, p. 42) recorded from the 'Coupe de Heunsberg près de Fauquemont' (i.e., the present-day Valkenburg aan de Geul/Sibbe area in southern Limburg, the Netherlands) two brittlestar species from a level rich in bryozoans, in particular the genus *Stellocavea* d'Orbigny, 1853, namely *Ophiura Furstenbergii* Muller [sic] and *Ophiura* sp. This probably refers to the Emael Member of the Maastricht Formation, but might also include the underlying Schiepersberg Member, from which fairly numerous specimens of *Ophiomusium* gr. *granulosum* have been collected in recent years. *Ophiura fürstenbergii* is an ophiacanthid (ophioplithacine), *Ophioplithaca? fuerstenbergii* (J. Müller, 1847), as outlined by Jagt (2000, p. 11, text-fig. 1, pl. 7, figs. 6-12, 13?, pl. 11, fig. 7?). This taxon is best known from the Vaals Formation (lower Campanian), but apparently closely related (if not conspecific) material has been recorded from the Benzenrade (lower upper Campanian) and Meerssen members, documenting a range from the lower Campanian to the uppermost Maastrichtian.

Binkhorst van den Binkhorst (1859a, p. 109) also noted that, in the same area, '.... la troisième couche à bryozoaires renfermant, comme nous l'avons déjà dit, un si grand nombre d'espèces nouvelles pour notre craie et pour la science, une *Ophiura*, etc.' This refers to the Meerssen Member and it is more than likely that the species listed below are involved.

In a later work, Binkhorst van den Binkhorst (1859b, p. 407) remarked that the so-called 'third bryozoan level' had yielded 'zahlreiche Exemplare einer *Ophiura* [sic], vielleicht *Ophiura Fürstenbergii* [sic]'. In view of the stratigraphic level involved, it appears more likely that this refers either to *F. vanderhami* or *O. lux*, or to both.

From these records, it would seem that the small collection reassessed here is only part of the ophiuroid material that Binkhorst had at his disposal, contained either in his own collection or in those of his contemporaries. The present lot comprises but two species, both common in the upper Maastricht Formation, notably in the Meerssen Member.

Material and methods

After Binkhorst's death in December 1876, his collection was purchased by the Kaiserliches Mineralogisches Museum, Berlin (now Museum für Naturkunde) (see van Regteren Altena, 1957; Krutzler, 1962, 1963; de Bruijn, 1974; Winkler Prins, 2000). Unfortunately, with the exception of echinoids and crinoids, none of the echinoderm material in this collection has been revised since. A few years ago, Dr Loïc Villier (then Humboldt Stipendium holder at Berlin, now Centre de Sédimentologie-Paléontologie, Université de Provence, Marseille, France) rediscovered the ophiuroid material in the Binkhorst Collection, and brought it to our attention. The associated label reads:

Ophiuren = Gattung.
Obersenon.
Maastricht.
coll. v. Binkhorst

Although the entire lot is thus considered to have come from Maastricht and environs (St Pietersberg in particular), it is quite possible that some (if not all) specimens

were collected in the Valkenburg aan de Geul area, from where Binkhorst van Binkhorst (1859a, b) recorded numerous brittlestars. Alternatively, material from various localities may have been lumped together, either by Binkhorst himself or during transfer of his collection to Berlin. Be that as it may, preservation of the specimens reassessed here clearly indicates provenance from the highest levels of the Maastricht Formation and, more precisely, from the Meerssen Member. In Binkhorst's days, this unit would have been better exposed in the Valkenburg aan de Geul area (inclusive of Geullhem) than at the St Pietersberg, south of Maastricht.

Specimens were measured (diameter and height of disc, width of arm at disc; see Table 1) and those that best revealed diagnostic features were selected for photography (Pl. 1), illustrating adoral and oral views of discs and proximal arm portions; no additional preparation was needed. All material is contained in the collections of the Museum für Naturkunde, bearing the prefix MB.E.

Reassessment of material

The present lot comprises thirteen specimens, four identifiable as *Felderophiura vanderhami* and nine as *Ophiomusium lux* (Table 1). Details of plating and mouth frame are obliterated by recrystallization and epitaxial cement to varying degrees in all specimens, some of which also lack certain plates, especially of the adoral surface.

Table 1. Registration numbers and measurements (in mm) of specimens studied; those marked with an asterisk are illustrated (see Pl. 1).

Specimen	disc diameter	disc height	arm width at disc
<i>Felderophiura vanderhami</i>			
MB.E 6572*	9.1	3.3	2.3
MB.E 6574*	7.3	2.2	2.1
MB.E 6577	6.9	2.3	2.2
MB.E 6578	6.3	2.1	1.9
<i>Ophiomusium lux</i>			
MB.E 6573*	7.4	2.3	1.8
MB.E 6575*	9.3	2.7	-
MB.E 6576*	8.0	2.7	1.7
MB.E 6579	8.3	2.7	-
MB.E 6580	7.8	2.7	-
MB.E 6581	7.3	2.3	1.7
MB.E 6582	8.0	2.4	1.8
MB.E 6583	6.3	1.9	1.8
MB.E 6584	6.9	2.5	1.7

Felderophiura vanderhami Jagt, 1991

Pl. 1, figs. 1-4.

- * 1991 *Felderophiura vanderhami* Jagt, p. 200, text-figs. 2, 3, pl. 1.
 2000 *Felderophiura vanderhami* Jagt; Jagt, p. 18, text-fig. 4, pl. 6, figs. 4-6, 8, 9, pl. 7, figs. 1-3, pl. 11, figs. 1-3, pl. 18, fig. 1(?).

Material – Four specimens, MB.E 6572, 6574, 6577 and 6578.

Brief description – The disc is small (6.3-9.1 mm in diameter), low, subcircular and flat, with straight interradian margins. Adoral plating comprises a distinct centrale (missing in all specimens studied here; Pl. 1, figs. 1, 3), a primary circlet and additional smaller plates. The interradian area has two large and a few smaller plates, alternatively a number of plates of various sizes, and a single large marginal plate (Pl. 1, fig. 3). Radial shields are large, triangular, only partially visible (Pl. 1, figs. 1, 3) and are separated above the arm base by two wedge-shaped plates (Pl. 1, figs. 1, 3). A small triangular

dorsal arm plate is seen between these two wedge-shaped plates (Pl. 1, fig. 3). Arms are widest at the base, and have well-developed lateral, dorsal and ventral arm plates (Pl. 1, figs. 1, 2). Lateral arm plates do not meet ventrally or dorsally. Tentacle pores are well developed (Pl. 1, figs. 2, 4). The genital slit is rather indistinct. There are no genital papillae, but the arm comb is distinct (Pl. 1, fig. 1). The adoral shield is large, longer than wide, widest proximally and acutely pointed (Pl. 1, fig. 4). A single apical papilla is seen at the end of each jaw. Two, possibly three, thick oral papillae occur on either side of the oral plate (Pl. 1, figs. 2, 4), and teeth are stout (Pl. 1, fig. 4).

Discussion – This form was originally interpreted as an ophiurid (i.e., belonging to the family Ophiuridae Lyman, 1865), but recent SEM observations have shown it to be an ophiolepidid (J.W.M. Jagt, S. Stöhr and B. Thuy, research in progress). The wedge-shaped plates above the arm base which separate the radial shields are diagnostic of this species; in all specimens these are easily seen, despite partial collapse of discs and concealment of details of plating.

Stratigraphic range – In the type area, *Felderophiura vanderhami* first appears, albeit rarely, in the basal Schiepersberg Member. The species ranges throughout the Emael, Nekum and Meerssen members (Maastricht Formation), and also occurs commonly in the Kunrade limestone facies (Jagt, 1991, 2000). A distinct acme has been recorded in the upper Meerssen Member.

***Ophiomusium lux* Jagt & Kutscher in Jagt, 2000**

Pl. 1, figs. 5-10.

* 2000 *Ophiomusium lux* Jagt & Kutscher in Jagt, p. 33, text-fig. 7, pl. 4, figs. 6-10, pl. 5, figs. 1-4, 7, pl. 6, figs. 3, 7, pl. 9, fig. 5, pl. 15, fig. 6, pl. 18, fig. 8.

Material – Nine specimens, MB.E 6573, 6575, 6576 and 6579-6584.

Brief description – The disc is small (6.3-9.3 mm in diameter), low, subpentagonal to subcircular, with straight interradial margins. Adoral plating comprises smooth, tumid plates and scales, including a distinct, almost circular central plate (missing in all specimens studied; Pl. 1, figs. 6, 8, 10), an interradial series of small triangular plates and a conspicuous second series composed of tumid ossicles (Pl. 1, figs. 6, 8, 10). The width of these plates, with straight to slightly convex margins, decreases notably towards the disc margin (Pl. 1, figs. 6, 8, 10); the interradial marginal plate is rounded elliptical in outline and abuts the radial shields along their distal margin (Pl. 1, figs. 5, 6); the distal interradial corner of a radial shield shows a characteristic incision for accommodation of the genital plate and a thin scale (Pl. 1, fig. 5); the oral disc surface is covered by comparatively few, large plates (Pl. 1, figs. 5, 7).

Discussion – Although preservation of the present material is much poorer than that of the types (Jagt, 2000, p. 33), the tumid plates of the interradially arranged second series and the large radial shields separated by a series of small plates are diagnostic features of this species, which preclude confusion with both *F. vanderhami* and *O. gr.*

granulosum (compare Jagt, 2000, p. 31, pl. 4, fig. 5, pl. 5, fig. 6, pl. 13, fig. 5, pl. 14, pl. 15, figs. 1-4, 7-8, pl. 20, figs. 6, 9).

Stratigraphic range – The present species is apparently confined to the Nekum and Meerssen members (Maastricht Formation), with an acme in the upper Meerssen Member. Like *F. vanderhami* it is also known from the upper portion of the Kunrade limestone facies.

Discussion

As noted above, the fact that only isolated discs (only some of which retain proximal arm portions, see Pl. 1, figs. 1, 2, 5, 6) are available clearly shows that Binkhorst must have used bulk sampling techniques in order to acquire this material. During washing and screening, even more or less completely preserved specimens are broken to varying degrees, and the lack of some adoral and oral disc plating may also have resulted from such sample treatment. However, in other cases, absence of particular disc plates (e.g., centrale in Pl. 1, figs. 3, 5, 7, 9; tentacle scales in Pl. 1, figs. 2, 4) and partial collapse of discs (e.g., Pl. 1, fig. 6), can be ascribed to taphonomic processes in the shallow-water, high-energy setting represented by the Meerssen Member.

The main interest of the present lot is historic. The material was collected more than a century and a half prior to the formal description of such echinoderms from the Maastrichtian type area, and is comprised of two of the commoner species in that area.

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Plate 1

Felderophiura vanderhami Jagt, 1991 (Figs. 1-4) and *Ophiomusium lux* Jagt & Kutscher in Jagt, 2000 (Figs. 5-10) from the Meerssen Member (Maastricht Formation, late Maastrichtian) in southern Limburg, the Netherlands, contained in the Binkhorst Collection (Museum für Naturkunde, Berlin). All specimens were coated with ammonium chloride prior to photography.

Figs. 1, 2. MB E.6574, adoral and oral views of disc and proximal arm, respectively. Note wedge-shaped ossicles separating radial shields on bottom right-hand side; disc plating partially missing and with strong epitaxial growth (Fig. 1); adoral shield, oral plate and scales, apical papillae and proximal ventral arm plates with tentacle pores well visible (Fig. 2). Largest disc diameter 7.3 mm.

Figs. 3, 4. MB E.6572, adoral and oral views of disc, respectively. Note wedge-shaped plates separating radial shields over each arm base (Fig. 3); acutely pointed adoral shield and stout teeth well visible (Fig. 4). Largest disc diameter 9.1 mm.

Figs. 5, 6. MB E.6573, oral and adoral views of disc, respectively. Note details of oral disc plating and mouth frame largely hidden by epitaxial growth (Fig. 5); conspicuous radial shields and radial disc plating; disc partially collapsed and centrale missing (Fig. 6). Largest disc diameter 7.4 mm.

Figs. 7, 8. MB E.6576, oral and adoral views of disc, respectively. Note marginal plate well visible; details of remainder of plating and mouth frame hidden by epitaxial growth (Fig. 7); large radial shields and conspicuous radial and interradial plating in two circlets; centrale missing (Fig. 8). Largest disc diameter 8.0 mm.

Figs. 9, 10. MB E.6575, oral and adoral views of disc, respectively. Note details of disc plating and mouth frame largely obliterated by epitaxial growth (Fig. 9); radial shields tilted, conspicuous interradial plating, centrale missing (Fig. 10). Largest disc diameter 9.3 mm.



